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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C.

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FEB 12 2002

In the Matter of)

Review of Part 15 and other Parts of the)
Commission's Rules)

ET Docket No. 01-278

RM-9375

RM-10051

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

COMMENTS OF XM RADIO INC.

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Summary

In September 2001, XM Radio Inc. ("XM") initiated its satellite Digital Audio Radio Service ("SDARS"), providing high-quality, continuous, nationwide multichannel digital audio service. In its first four months of service, XM has proven to be a tremendous success. XM has won numerous awards, including Fortune Magazine's Product of the Year, and achieved 30,000 subscribers in its first eight weeks of service, making it the fastest selling audio product of the last twenty years. SDARS is truly bringing about the consumer benefits the Commission hoped it would when it issued SDARS licenses to XM and Sirius Satellite Radio Inc. ("Sirius") in 1997.

XM is concerned with the proliferation of unlicensed devices operating in the 2.4 GHz band and family radios operating on Channels 8-14 at 467 MHz pursuant to current Commission out-of-band emissions limits. These devices include communications devices such as cordless phones and new "Bluetooth," IEEE 802.11, and HomeRF devices that enable wireless internet access and short-range communications between computing and telecommunications devices like laptop computers, cellular phones, Palm Pilots, wireless headphones, and other equipment. These devices also include Industrial, Scientific, and Medical ("ISM") devices, such as microwave ovens and RF lights.

XM urges the Commission to update the limits on out-of-band emissions by unlicensed devices to protect SDARS consumers. In the next few years there will be millions of SDARS receivers operating in close proximity to millions of unlicensed devices, many of which operate in the same frequency range. Prompt action by the Commission thus represents prudent spectrum management. The present out-of-band emissions limits applicable to these Part 15 and Part 18 devices were adopted at a time when there were no consumer-oriented mass media services operating above 1000 MHz and relatively few unlicensed devices operating at 2.4 GHz.

XM is not proposing that any existing unlicensed devices be required to cease operation and the updated limits proposed herein will not be expensive for manufacturers of unlicensed devices to meet. A recent study shows that the SDARS frequencies at present are free of virtually any noise. It is critical to SDARS consumers that the Commission preserve that situation.

Specifically, XM urges the Commission to establish, effective 18 months after adoption, an out-of-band emissions limit into the 2320-2345 MHz band of no more than 18 $\mu\text{V}/\text{m}$ at 3 meters measured in a 2 MHz interval for all unlicensed devices operating exclusively inside of vehicles and 8.6 $\mu\text{V}/\text{m}$ at 3 meters measured in a 1 MHz interval for unlicensed devices operating in all other environments. XM urges the Commission to apply these emission limits to the following unlicensed devices: (i) spread spectrum and other unlicensed devices operating pursuant to Part 15 of the Commission's rules; (ii) ISM devices operating in the 2400-2483.5 MHz band pursuant to Part 18 of the Commission's rules; and (iii) family radios operating pursuant to Part 95 of the Commission's rules on Channels 8-14 at 467 MHz.

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COMMENTS OF XM RADIO INC.

XM Radio Inc. ("XM") hereby files these comments urging the Commission to adopt rules to protect consumer receivers of satellite Digital Audio Radio Service ("SDARS") at 2.3 GHz from interference from out-of-band emissions from unlicensed devices operating pursuant to Part 15, Part 18, and Part 95 of the Commission's rules. To protect SDARS receivers, the Commission should update its rules to establish an out-of-band emissions limit into the 2320-2345 MHz band of no more than 18 $\mu\text{V/m}$ at 3 meters measured in a 2 MHz interval for unlicensed devices operating exclusively inside of vehicles and 8.6 $\mu\text{V/m}$ at 3 meters measured in a 1 MHz interval for unlicensed devices in all other environments.¹ XM urges the Commission to apply these emission limits to the following unlicensed devices: (i) spread spectrum and other unlicensed devices pursuant to Part 15 of the Commission's rules; (ii) industrial, scientific, and medical ("ISM") devices operating in the 2400 – 2483.5 MHz ("2.4 GHz") band pursuant to Part 18 of the Commission's rules; and (iii) family radios operating

¹ Sirius Satellite Radio Inc. ("Sirius"), the other SDARS licensee, recently filed a Petition for Rulemaking proposing these same emissions limits for Part 15 and Part 18 unlicensed devices. See Sirius Satellite Radio Inc., Petition for Rulemaking (Jan. 23, 2002). XM supports Sirius's Petition and urges the Commission to consider Sirius's Petition in the context of the above-captioned proceeding. XM notes that its concerns with out-of-band emissions from unlicensed devices also extends to family radios operating on channels 8-

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pursuant to Part 95 of the Commission's rules on Channels 8-14 at 467 MHz. By acting expeditiously, the Commission can prevent the development of a major interference problem, potentially affecting tens of millions of consumers, and do so without imposing any significant costs on industry or the public.

Background

The Development of SDARS in the S-band. In 1995, the Commission allocated spectrum in the S-band to the satellite Digital Audio Radio Service. XM and Sirius Satellite Radio Inc. ("Sirius") were the winning bidders in the SDARS auction held in April 1997, together committing nearly \$170 million to the U.S. Treasury.² XM was awarded the license to provide SDARS in the 2332.5 – 2345 MHz band. As the Commission has repeatedly recognized, this new consumer-based mass media service promises enormous public interest benefits for the U.S. public.³

Since its licensing, XM and Sirius have made extraordinary progress in the development of their SDARS systems. Both licensees are now fully funded through their scheduled initiation of commercial service, having raised billions of dollars in the process. Both XM and Sirius have successfully launched their satellites. In September 2001, XM initiated commercial service, providing high-quality, continuous, nationwide multichannel audio service. XM in its first three months of service has proven to be a great success. One need only look at the 30,000 customers

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14 at 467 MHz, whose transmitted fifth harmonic falls within XM's, but not Sirius's, licensed frequency band.

² American Mobile Radio Corporation, 13 FCC Rcd 8829 (Int'l Bur., 1997); Satellite CD Radio, 13 FCC Rcd 7971 (Int'l Bur., 1997).

³ See, e.g., Establishment of Rules and Policies for the Digital Audio Radio Satellite Service in the 2310-2360 MHz Frequency Band, *Report and Order, Memorandum Opinion and Order*, 12 FCC Rcd 5754, ¶ 1 (1997) ("SDARS Order").

XM has acquired in its first eight weeks of service and the numerous awards XM has already won, including Fortune Magazine's Product of the Year,⁴ to realize that SDARS is bringing about the consumer benefits the Commission hoped it would. The availability of SDARS is increasing the variety of programming available to the listening public, offering an unprecedented variety of music and information, including in areas of the country that have traditionally been underserved by terrestrial radio stations.⁵ As discussed below, however, XM is concerned with the expected proliferation of unlicensed devices operating pursuant to current Commission out-of-band emissions limits and the interference they may cause to SDARS receivers.

SDARS subscribers are investing in the service by purchasing and installing SDARS radios. Reception of SDARS depends on the transmission of a signal from a satellite to a very small antenna. SDARS receivers are expected to be used predominantly in mobile environments, but SDARS is also expected to be popular in homes and other fixed locations. While XM's satellites are state-of-the-art and among the most powerful communications satellites ever manufactured, the downlink signal power available to the receiver is much lower than terrestrial-based communications systems, thereby requiring very sensitive SDARS receivers. The sensitivity of SDARS reception to interference in the car environment is described in further detail in Exhibit A. Moreover, due to the nature of the service, a digital audio broadcast system requires a service availability of over 99%. The loss of an adequate

⁴ Peter Lewis, *My Favorite Things*, Fortune Magazine, Dec. 24 2001, at 169 (naming XM Satellite Radio "Product of the Year" and stating "[o]f all the new technologies of 2001, XM Satellite Radio is way, way, way above the rest. It's the first major advance in radio since FM emerged in the 1960s, and the best thing to happen to mobile music since the dashboard CD player.").

⁵ *SDARS Order* at ¶ 1.

signal will produce a total loss of audio. Therefore, the availability requirements for an SDARS system are much more stringent than that of mobile telephony systems. People using mobile phones have accepted the fact that intermittent outages or bursts of noise occur during the course of a conversation. Intermittent outages or bursts of noise will not be tolerated by an SDARS subscriber who is paying for uninterrupted, high-quality digital radio.

XM provides service to its subscribers directly through its licensed SDARS satellites in over 99% of its coverage area. Terrestrial repeaters are used only to provide service in urban areas and elsewhere where it may be difficult to receive satellite-based signals due to line-of-sight blockage from foliage, buildings, and other obstacles. Even within the coverage area of the terrestrial repeater, there will be areas where the amplitude of the terrestrial signal is close to the receiver threshold.

The Commission has made clear that SDARS subscribers can expect to receive high-quality service without the threat of unreasonable interference. The Commission has stated that that “[i]n authorizing DARS, it was our desire to ensure a high quality radio service.”⁶ The Commission further stated that:

We [recognize] that the 2320-2345 MHz frequency band is the only spectrum specifically available for provision of Satellite DARS in the United States. Accordingly, if Satellite DARS in this spectrum is subject to excessive interference, the service will not be successful and the American public will not benefit from the service. *WCS Order* at ¶ 27.

Proliferation of Unlicensed Devices. XM has identified three types of unlicensed devices that are presently allowed to transmit out-of-band emissions at levels that have the potential to interfere with reception of SDARS satellite signals: (i) spread spectrum and other radio

⁶ Amendment of the Commission’s Rules to Establish Part 27, the Wireless Communications Service (“WCS”), *Memorandum Opinion and Order*, 12 FCC Rcd 3977, ¶ 25 (1997) (“*WCS Order*”).

frequency devices operating in the 2.4 GHz band and other unlicensed devices operating pursuant to Part 15 of the Commission's rules; (ii) industrial, scientific, and medical ("ISM") devices operating in the 2.4 GHz band pursuant to Part 18 of the Commission's rules; and (iii) family radios operating on an unlicensed basis on Channels 8-14 at 467 MHz pursuant to Part 95 of the Commission's rules, whose transmitted fifth harmonic could cause interference to XM's SDARS receivers.

Unlicensed Part 15 Devices. In general, Part 15 of the Commission's rules governs unlicensed radio frequency ("RF") devices. Examples of such devices includes garage door openers, remote controls, and cordless phones.⁷ One of the bands available for the operation of Part 15 RF devices is the 2400-2483 MHz ISM band, just 55 MHz from the edge of XM's licensed frequency band.

As a result of developments in digital technology, applications such as unlicensed wireless internet access and short-range communications between computing and telecommunications devices like laptop computers, cellular phones, PDAs, wireless headphones, and other equipment have started to become and will become increasingly common operating in the 2.4 GHz band in the same environment as SDARS receivers. A joint venture of a number of companies, including Microsoft, Nokia, Motorola, IBM, Ericsson, and Intel, has proposed the "Bluetooth" standard, which is intended to enable users to wirelessly interconnect PDAs, cell phones, cameras, computers, and other mobile devices. The Bluetooth project is an example of an effort to develop wire replacement, spread spectrum devices which operate in the 2.4 GHz

⁷ The Commission is also currently considering authorizing ultra-wideband ("UWB") devices under Part 15. See Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems, *Notice of Proposed Rulemaking*, ET Docket 98-153 (May 11, 2000) ("*UWB NPRM*").

band.⁸ One expected application for Bluetooth devices is to enable hands-free use of mobile phones in vehicles.⁹ While projections regarding the specific rate and scope of Bluetooth deployment vary, one research group recently predicted that there will be 1.4 billion Bluetooth-enabled devices in the market in 2005.¹⁰ In addition, Bluetooth transmitters over time will be used for an increasing variety of functions. Printers, fax machines, Wireless LANs, and other equipment will be able to communicate with each other, and most cellular phones, two-way pagers, wireless data-only terminals, and most other two-way, wireless-capable devices will be Bluetooth-equipped.¹¹

Current Out-of-Band Emissions Limit Applicable to Part 15 Devices. In 1989, the Commission established a general framework for emissions limits for all unlicensed Part 15 intentional radiators, now contained in Section 15.209.¹² In that order, the Commission applied

⁸ Spread spectrum devices spread the emitted energy over a wide bandwidth, using either a method of direct sequencing, frequency hopping, time hopping, pulsed FM, and hybrid systems, which makes the emission more resistant to interference from other sources. Authorization of Spread Spectrum and Other Wideband Emissions Not Presently Provided for in the FCC Rules and Regulations, *First Report and Order*, 1985 FCC LEXIS 4159, ¶ 1 n.1 (1985) (“*Spread Spectrum Order*”).

⁹ See Press Release, “Bluetooth Wireless Technology in Automotive Applications,” (Oct. 16, 2001) (available at <http://www.bluetooth.com/news/>).

¹⁰ See “Bluetooth Emergence Explained at ABI Conference,” PR Newswire (April 11, 2001) (citing report of Allied Business Intelligence); see also Melanie Reynolds, “Bluetooth Boomtime Over Next Five Years, Say Reports,” *Electronics Weekly*, July 18, 2001, at p. 3 (citing a Micrologic Research report that there will be a huge increase in demand for Bluetooth chipsets, with sales going from 0.4 million units in 2000 to 1.156 billion units in 2005).

¹¹ *Bluetooth Technology: Look, Ma! No Cable*, Computers Today, February 15, 2000, at p.56.

¹² After decades of regulating unlicensed radiators on a patchwork basis and applying different emissions limits to specific devices and frequency bands, the Commission’s 1989 Order overhauled Part 15. See Revision of Part 15 of the Rules Regarding the Operation of Radio Frequency Devices Without an Individual License, *First Report and Order*, 4 FCC Rcd 3493, ¶ 5 (1989) (“*1989 Part 15 Order*”). In this new general framework, the Commission divided the RF spectrum into segments and established different emissions limits for intentional radiators operating in each of these spectrum bands. *Id.* at ¶¶ 20-29.

an emissions limit of 500 $\mu\text{V/m}$ at 3 meters to unlicensed intentional radiators operating above 960 MHz.¹³ Thus, under the Commission's current rules, 2.4 GHz devices are not permitted to emit a signal with a field strength exceeding 500 $\mu\text{V/m}$ at 3 meters into the "restricted" band at 2310-2390 MHz, which includes the S-band SDARS allocation. 47 C.F.R. §§ 15.209, 15.247.¹⁴ As discussed in Exhibit A, this limit is not adequate to protect SDARS receivers. To the extent that these Part 15 devices operate in close physical proximity to SDARS receivers, they have the potential to cause interference to reception of SDARS.

As discussed further in Exhibit A, the Bluetooth technical specification is designed to permit out-of-band emissions at the current Part 15 level. XM's discussions with the Automotive Multimedia Interface Collaboration (AMIC) have indicated that Bluetooth and other unlicensed RF devices to be employed in automobiles will be required to meet an out-of-band emissions limit of 18 $\mu\text{V/m}$ at 3 meters into the SDARS band.

In addition to the Bluetooth technology, communications companies are designing systems using alternative technologies to operate in the 2.4 GHz band. This includes systems like the IEEE 802.11b (WiFi) and HomeRF.¹⁵ These systems are designed to operate in a spread spectrum mode like the Bluetooth system, but are not expected to be deployed, as Bluetooth will be, in the automotive environment. These systems will be found extensively in the workplace

¹³ The Commission initially deferred application of its general Section 15.209 limits to spread spectrum devices. These limits were formally applied to out-of-band emissions from spread spectrum devices one year later. Amendment of Parts 2 and 15 of the Rules With Regard to the Operation of Spread Spectrum Systems, *Report and Order*, 5 FCC Rcd 4123, ¶¶ 28-29 (1990).

¹⁴ Similarly, the field strength of radiated emissions above 960 MHz from unintentional radiators may not exceed 500 $\mu\text{V/m}$ at 3 meters, except for Class A digital devices which are restricted to 300 $\mu\text{V/m}$ at 3 meters. 47 C.F.R. § 15.109(a), (b).

¹⁵ "Wireless LANs Explode with a Kaleidoscope of Options," *Electronic Design*, No. 11, Vol.48, May 29, 2000, at p.71.

and home, however, and the potential interference from such operations is another area of concern for SDARS, if their out-of-band emissions are as high as Part 15 rules currently permit.

In May 2001, the Commission initiated a Further Notice of Proposed Rulemaking (“FNPRM”) proceeding to amend Part 15 of its rules to facilitate the development and deployment of new unlicensed wireless devices operating in the 2.4 GHz band.¹⁶ The Commission sought comment on proposed amendments to its rules designed to improve spectrum sharing by unlicensed devices in the 2.4 GHz band, provide for introduction of new digital transmission technologies, and eliminate certain regulations for spread spectrum systems. *Spread Spectrum FNPRM* at ¶ 1. Both XM and Sirius filed comments in this proceeding noting their concern that the current out-of-band emissions limits applicable to Part 15 devices operating in the 2.4 GHz band does not adequately protect SDARS receivers and that the proliferation of unlicensed Part 15 devices in the 2.4 GHz band threatens the performance of SDARS.¹⁷

ISM Devices Operating Pursuant to Part 18 in the 2.4 GHz ISM Band. ISM equipment, such as microwave ovens, industrial heating equipment, welding equipment, and RF lighting devices use RF energy to perform a function other than communications. These devices emit RF energy into the ether as a result of their use of such energy. One of the bands available for the operation of ISM devices is the 2.4 GHz band.

Current Out-of-Band Emissions Limits Applicable to Part 18 ISM Devices Operating in the 2.4 GHz Band. Section 18.305(b) Commission’s rules establishes differing out-of-band

¹⁶ Amendment of Part 15 of the Commission’s Rules Regarding Spread Spectrum Devices, *Further Notice of Proposed Rulemaking and Order*, ET Docket No. 99-231 (May 11, 2001) (“*Spread Spectrum FNPRM*”).

¹⁷ Comments of Sirius, ET Docket No. 99-231 (August 27, 2001); Reply Comments of XM, ET Docket No. 99-231 (September 25, 2001).

emissions levels for varying types of ISM devices. 47 C.F.R. § 18.305(b). For example, the current out-of-band emissions limit for “miscellaneous” ISM devices generating an RF power greater than 500 watts is $25 * \text{square root of } (\text{power}/500 \text{ watts})$ at 300 meters, which is equivalent to approximately 3500 $\mu\text{V}/\text{m}$ at 3 meters for a 1000 watt device. To the extent that Part 18 ISM devices operate in close proximity to SDARS receivers at present out-of-band emissions levels, they have the potential to cause interference to reception of SDARS.

The Commission is presently considering the appropriate out-of-band emissions limit for one type of ISM device, RF lighting devices, that will operate in the 2.4 GHz ISM band.¹⁸ While Section 18.305(c) of the Commission’s rules establishes out-of-band emissions limits for RF lighting devices operating below 1000 MHz, there are no out-of-band emissions limits specifically applicable to RF lighting devices operating in the 2.4 GHz band. Thus, these lighting devices are allowed to operate pursuant to the out-of-band limit of $25 * \text{square root of } (\text{power}/500 \text{ watts})$ at 300 meters for “miscellaneous” ISM devices. In its NPRM on RF lighting devices operating in the 2.4 GHz band, the Commission stated “[w]e are particularly concerned that this [out-of-band] energy could cause interference to other services operating near the 2450 MHz band, such as the Digital Audio Radio Service operating in the 2320-2345 MHz frequency band.”¹⁹ To address this concern, the Commission proposed an emissions limit of 500 $\mu\text{V}/\text{m}$ at 3 meters for consumer RF lighting equipment and an emission limit of 100 $\mu\text{V}/\text{m}$ for non-consumer RF lighting equipment. XM and Sirius have actively participated in this proceeding, establishing that the Commission’s proposed emissions limit for 2.4 GHz RF lighting devices is

¹⁸ Amendment of Part 18 of the Commission’s Rules to Update Regulations for RF Lighting Devices, *Notice of Proposed Rulemaking*, 13 FCC Rcd 11307 (1998) (“*RF Lighting NPRM*”).

¹⁹ *Id.* at ¶ 12 (1998).

not sufficient to protect SDARS receivers and that Commission should instead adopt an emissions limit of 8.6 $\mu\text{V/m}$ at 3 meters for these lights. This proceeding is still pending.

Family Radios. In 1996, the Commission established the Family Radio Service designed to provide a very short distance, unlicensed, two-way voice personal radio service.²⁰ Family radios have become an extremely popular means to communicate over short distances.²¹ In December 2001, the Commission proposed to amend the FRS rules to allow family radios to transmit data.²²

Family radios are authorized to operate on certain frequencies at 462 MHz (Channel 1-7) and 467 MHz (Channels 8-14). 47 C.F.R. § 95.627. The transmitted fifth harmonic of family radios operating on Channels 8-14 falls within XM's licensed frequency band of 2332.5 – 2345 MHz.

Current Out-of-Band Emissions Limits Applicable to Part 95 Family Radios. Family radios are required to attenuate power by at least $43 + 10 \log (T)$ dB, where T is transmitter power, on any frequency removed from the center of the authorized bandwidth by more than 250%. 47 C.F.R. § 95.935(b)(7). To the extent that family radios operating on Channels 8-14 are in close physical proximity to an SDARS receiver operating at present out-of-band emissions levels, they have the potential to cause interference to reception of SDARS.

²⁰ Amendment of Part 95 of the Commission's Rules to Establish a Very Short Distance, Two-Way Voice Radio Service, *Report and Order*, 11 FCC Rcd 12977 (May 1996).

²¹ Leonard Wiener, "Hello? Can you hear me? Walkie-talkies are the rage," U.S. News and World Report, p. 57 (July 2, 2001) (stating that 1.1 million family radios were sold in the first four months of 2001); Gary Shapiro, "Furnishing the Ultimate Living Room and Beyond," *Appliance*, p. 65 (January 1, 2001) (noting that sales of family radios will continue to grow in 2001).

²² Garmin International, Inc., *Notice of Proposed Rulemaking*, WT Docket No. 01-339 (Dec. 20, 2001).

Commission Concern with Rise in the Noise Floor from Unlicensed Devices. The Commission has begun to acknowledge an increase in the amount of noise and the potential for interference in the radio spectrum due to the proliferation of unlicensed devices. In June 2000, the Commission's Technological Advisory Council ("TAC") announced its interest in a study of radio spectrum noise and established a Spectrum Management focus group to study this issue.²³

Unlicensed Device NPRM. In the above-captioned NPRM, the Commission proposes to modify its emissions limits on certain unlicensed devices operating above 2 GHz.²⁴ The Commission states that a review is needed to ensure "continued growth in the area of unlicensed devices while protecting against harmful interference to authorized services." NPRM at ¶ 2. While the SDARS licensees have expressed their concerns regarding out-of-band emissions of unlicensed devices operating in the 2400 - 2483.5 MHz band in the radio frequency ("RF") lighting,²⁵ ultra-wideband ("UWB"),²⁶ and spread spectrum device proceedings,²⁷ the

²³ A list of the TAC's focus groups is available at <http://www.fcc.gov/oet/tac/focusgroups.html>

²⁴ See Review of Part 15 and Other Parts of the Commission's Rules, *Notice of Proposed Rulemaking and Order*, ET Docket 01-278 (Oct. 15, 2001) ("*Part 15 NPRM*").

²⁵ In its NPRM on RF lighting, the Commission itself expressed concern with the potential for interference to SDARS from out-of-band emissions from RF lights. See *RF Lighting NPRM* at ¶ 12 ("We are particularly concerned that this [out-of-band] energy could cause interference to other services operating near the 2450 MHz band, such as the Digital Audio Radio Service operating in the 2320-2345 MHz frequency band."); see, e.g., Comments of XM (f/k/a American Mobile Radio Corporation), ET Docket No. 98-42 (July 8, 1998); Reply Comments of XM (f/k/a American Mobile Radio Corporation), ET Docket No. 98-42 (August 7, 1998); Joint Comments of XM and Sirius, ET Docket No. 98-42 (May 4, 2001); Letter from Phil Barsky, XM, and Rob Briskman, Sirius, to Ms. Magalie Roman Salas, ET Docket 98-42 (June 29, 2001); Letter from Bruce D. Jacobs, Counsel for XM, and Carl R. Frank, Counsel for Sirius, to Ms. Magalie Roman Salas, ET Docket 98-42 (August 2, 2001).

²⁶ See, e.g., Comments of XM, ET Docket No. 98-153 (Sept. 12, 2000); Reply Comments of XM, ET Docket No. 98-153 (Oct. 27, 2000); Supplemental Comments of Sirius, ET Docket No. 98-153 (Feb. 23, 2001); Supplemental Reply Comments of Sirius, ET Docket No. 98-153 (March 12, 2001); Reply Comments of XM, ET Docket No. 98-153 (March 12, 2001); Comments of Sirius, ET Docket No. 98-153 (April 25, 2001); Reply

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Commission does not specifically address these concerns in the NPRM. The Commission does note, however, that the above-captioned proceeding is intended as a general review and update of Part 15 and Part 18 of the Commission's Rules and of emissions limits from unlicensed devices operating above 2 GHz. NPRM at ¶¶ 1, 2-3, 7.

Discussion

I. THE COMMISSION'S EXISTING OUT-OF-BAND EMISSIONS LIMITS FOR UNLICENSED DEVICES ARE NOT ADEQUATE TO PROTECT SATELLITE DARS RECEIVERS AND SHOULD BE UPDATED

A. The Commission Has a Fundamental Obligation to Protect Licensed Services

The Commission has a fundamental obligation to protect licensed services such as SDARS from interference by emissions from unlicensed devices. The Commission's Part 15 and Part 18 rules establish an absolute obligation for operators of unlicensed devices to avoid causing harmful interference to licensed services.²⁸ For example, with respect to Part 15 devices, the Commission has stated that "the most basic principle of Part 15 operation is the requirement to

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Comments of Sirius, ET Docket No. 98-153 (May 10, 2001); Reply Comments of XM, ET Docket No. 98-153 (May 10, 2001).

²⁷ See *Spread Spectrum FNPRM*; Reply Comments of XM, ET Docket No. 99-231 (September 25, 2001); see also Comments of Sirius, ET Docket No. 99-231 (August 27, 2001).

²⁸ 47 C.F.R. § 15.5(b) ("Operation of an intentional, unintentional, or incidental radiator is subject to the conditions that no harmful interference is caused and that interference must be accepted that may be caused by the operation of an authorized radio station, by another intentional or unintentional radiator, by industrial, scientific and medical (ISM) equipment, or by an incidental radiator."); 18.111(b) ("the operator of ISM equipment that causes harmful interference to any authorized radio service shall promptly take whatever steps may be necessary to eliminate the interference"); 18.115(a) ("The operator of ISM equipment that causes harmful interference to radio services shall promptly take appropriate measures to correct the problem.").

function in a non-interfering manner in the midst of licensed devices.”²⁹ Similarly, the Commission’s rules regarding the family radio service provide family radio operators and manufacturers with notice that the Commission may require technical changes to equipment to solve interference problems caused by harmonic emissions.³⁰ XM has relied on these fundamental Commission rules in bidding approximately \$90 million for its SDARS license and in designing its SDARS system.

B. The Out-of-Band Emissions Rules Should be Updated

While the Commission’s current rules may have been sufficient to protect all licensed services above 1000 MHz in 1989-1990, circumstances have changed with respect to the deployment of both licensed and unlicensed devices and the old rules are no longer adequate.

1. There Were Previously No Consumer-Oriented Mass Media Services Above 960 MHz

The Commission places particular emphasis on protecting consumer-oriented communications services such as broadcast television and radio from harmful interference.³¹ In 1979, the Commission imposed a tougher emissions standard on computer devices (now called

²⁹ Amendment of Part 15 of the Commission’s Rules Regarding Spread Spectrum Devices, *First Report and Order*, 15 FCC Rcd 16244, ¶ 25 (August 31, 2000).

³⁰ 47 C.F.R. § 95.635 Note 4 (“If spurious or harmonic emissions result in harmful interference (any transmission, radiation or induction that endangers the functioning of a radionavigation or other safety service or seriously degrades, obstructs or repeatedly interrupts a radiocommunication service operating in accordance with applicable laws, treaties and regulations), the FCC may, at its discretion, require appropriate technical changes in the station equipment to alleviate the interference, including the use of a low pass filter between the transmitter antenna terminals and the antenna feed line.”).

³¹ The Commission has also worked to protect satellite services from interference caused by the operation of unlicensed devices, in recognition of the vulnerability of satellite downlinks to interference, due to their typically low carrier-to-noise ratios. *See 1989 Part 15 Order* at ¶ 61 n.22. In fact, several of the Commission’s restricted bands are satellite downlink bands, and the Commission in 1985 specifically precluded the operation of spread spectrum devices in a portion of the 5 GHz band already allocated to FSS. *Spread Spectrum Order* at ¶ 24.

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“digital devices” in Part 15) used in residential environments than on computer devices used in commercial or industrial settings; this policy was designed to protect consumers’ use of televisions and radios in the home.³² The Commission explained that “[w]hile the precise size of the benefits is difficult to measure, it is clear that the benefits of television viewing and radio services -- both services with which computers can interfere -- are substantial.” *Computer Order* at ¶ 68.

Ten years later, in the *1989 Part 15 Order*, the Commission stated that tightening of its Part 15 rules was necessary “to reduce interference to authorized radio services, in particular, the AM broadcast service,”³³ and indicated that few if any unlicensed intentional radiators would be certified to operate in the TV band in order to protect future HDTV operations. *1989 Part 15 Order* at ¶ 51. While the Commission has not classified the broadcast TV frequency band as a “restricted” band, it has provided broadcast TV with protection from interference by denying requests to certify unlicensed devices to transmit in the TV band.³⁴

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³² See 47 C.F.R. § 15.3(h), (i); Amendment of Part 15 to Define and Clarify the Rules Governing Radiating Devices and Low Power Communication Devices, *First Report and Order*, 69 FCC 2d 28 (1979) (“*Computer Order*”). In addition, the Commission on reconsideration stated that, “[i]n the home, the TV and AM/FM broadcast receivers are the most susceptible to interference from a computing device. For protection of radio and TV reception in the home, the Commission is adhering to the radiation limits proposed in the Notice with some relaxation at the higher frequencies.” Amendment of Part 15 to Define and Clarify the Rules Governing Radiating Devices and Low Power Communication Devices, *Order Granting in Part Reconsideration of First Report and Order*, 79 FCC 2d 67, ¶ 52 (1980).

³³ *1989 Part 15 Order* at ¶ 13.

³⁴ Amendment of Part 15 of the Commission’s Rules to Permit Operation of Biomedical Telemetry Devices on VHF TV Channels 7-13 and on UHF TV Channels 14-46, *Report and Order*, 12 FCC Rcd 17828, ¶ 5 (1997) (“*Biomedical Telemetry Order*”). As an exception to this policy, certain medical telemetry devices are permitted to transmit in the

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When the relevant out-of-band emissions limits were adopted in 1989-1990, there were no consumer-based mass media services authorized above 960 MHz. As a result, despite the fact that the 500 $\mu\text{V/m}$ at 3 meters standard currently applicable to Part 15 devices is significantly more liberal than the out-of-band emissions limits below 960 MHz (for instance, the limit at 216-960 MHz is 200 $\mu\text{V/m}$ at 3 meters), the Commission apparently viewed this limit as stringent enough to protect the licensed services above that frequency threshold. 47 C.F.R. § 15.209.

With the subsequent allocation and licensing of SDARS in the S-band, however, the Commission needs to maintain its traditional policy of protecting consumer-oriented communications services, and it should revisit its out-of-band emissions limits above 1000 MHz. Even more than other media services, the success of SDARS relies on its ability to deliver high-quality performance. If SDARS listeners experience chronic interference and loss of audio, even if those interruptions are intermittent and for a short duration, high quality service will be lost. New classes of unlicensed devices, many of which are being developed for widespread deployment in a mobile environment, could cause chronic interference to SDARS receivers.

In 1989, when the rules were last revised, the vast majority of unlicensed intentional radiators were used in a small number of residential or commercial environments and few, if any, were designed for use in automotive settings. In fact, in establishing the 500 $\mu\text{V/m}$ at 3 meters out-of-band emissions limit for unlicensed intentional radiators above 960 MHz in 1989, the Commission emphasized that this was the limit applied one year earlier to remote control devices and in-building security alarm transmitters, the presumed prototype devices above 960 MHz. *1989 Part 15 Order* at ¶¶ 26, 73-74. In the 1988 Order regarding those devices, the Commission

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TV band subject to numerous strict operating conditions. *See, e.g., Biomedical Telemetry*
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explained that (i) emissions above 960 MHz are vulnerable to blockage by physical obstacles and generally do not travel far enough to pose a substantial threat of interference, and (ii) the remote control and security devices at issue are typically installed or used in enclosed areas.³⁵

The Commission's rationale for a uniform limit of 500 $\mu\text{V}/\text{m}$ at 3 meters for devices operating above 960 MHz is no longer valid today. These unlicensed devices are no longer limited to remote control devices, security alarms, and other niche products. Now, broad-based initiatives such as Bluetooth, 802.11b, and HomeRF promise consumers a wide range of unlicensed communications and information services across a variety of environments, including many services in automotive settings where SDARS subscribers are likely to do most of their listening. As indicated above, it is likely that *millions* of these unlicensed transmitters, including spread spectrum devices in the 2.4 GHz band, will soon be entering the RF environment in the United States. As a result, there is a high probability that these devices will frequently be used in close proximity to operating SDARS receivers, and the shorter range of transmissions above 960 MHz is therefore no longer a legitimate justification for a less stringent standard above that threshold.

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Order.

³⁵ Amendment of the Rules Regarding Control and Security Alarm Devices Under Part 15, *Report and Order*, 3 FCC Rcd 1702, ¶ 16 (1988). The Commission's more general application of this 500 $\mu\text{V}/\text{m}$ at 3 meters standard to all intentional radiators above 960 MHz was also based on a recommendation from the NTIA, but the NTIA report at issue fails to provide any explanation for the effectiveness of that limit. *See 1989 Part 15 Order* at ¶ 20; "Technical Subcommittee (TSC) Review of the Federal Communications Commission's Draft Notice of Proposed Rule Making in the matter of Revision of Parts 2 and 15 of the Rules Regarding the Operation of Non-licensed Radio Frequency Devices,"

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2. The Commission Has Acknowledged the Importance of Updating Its Unlicensed Device Rules in Response to Changing Circumstances, and Such Changed Circumstances Are Present in This Case

The Commission has explicitly acknowledged that rules for unlicensed devices established at one point in time may no longer be appropriate or effective at a future time, as a result of relevant technological, commercial, and regulatory developments. In its 1989 Order establishing a new Part 15 framework, the Commission stated the following:

Early standards adopted to control interference are frequently significantly different from what is needed at the present time due to improvements in equipment, such as receiver sensitivity, the increased proliferation of both licensed and non-licensed operations, and changes to the frequency allocations of authorized radio services. *Part 15 Order* at ¶ 4.

As described above, the circumstances in the RF environment above 960 MHz, and in particular in the vicinity of the 2.4 GHz band, have changed dramatically since 1989 when the Commission established its general emissions limits. As the Commission acknowledges in the NPRM:

The last significant change to these [emissions] limits was made in 1989, so they have been essentially unchanged for over ten years. During this period, the commercial use of spectrum above 2 GHz has increased significantly. Licensed and unlicensed devices operating above 2 GHz have proliferated *NPRM* at ¶ 6.

Given these changes, there is no longer any justification for the continued general applicability of the Commission's current out-of-band emissions limit above 960 MHz. The Commission should do "what is needed at the present time" (*1989 Part 15 Order* at ¶ 4) to provide sufficient protection to SDARS, and update its emissions limits as described in the section below.

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National Telecommunications and Information Administration, U.S. Department of
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II. THE FCC SHOULD REVISE ITS OUT-OF-BAND EMISSION LIMITS FOR UNLICENSED DEVICES OPERATING IN THE 2.4 GHZ BAND AND FAMILY RADIOS OPERATING ON CHANNELS 8-14

A. Without More Stringent Emission Limits, Unlicensed Devices Operating in the 2.4 GHz ISM Band and Family Radios Operating on Channels 8-14 Will Cause Harmful Interference to SDARS Reception

SDARS licensees are somewhat more susceptible to out-of-band interference from unlicensed devices than other licensees. First, the upper edge of the SDARS frequency band is only 55 MHz from the lower edge of the 2400 –2483.5 MHz band where many unlicensed devices operate. In addition, for XM, the transmitted fifth harmonic of family radios operating on Channels 8-14 fall within XM’s licensed frequency band of 2332.5 – 2345 MHz. Second, the downlink signal power available to an SDARS receiver is much lower than terrestrial-based communications systems, thereby requiring very sensitive SDARS receivers.³⁶ In addition, because SDARS receivers operate in a mobile environment, they use omnidirectional antennas that eliminate the ability to “point” an antenna away from a source of interference. Third, unlike cellular, PCS, and other wireless telecommunications services, SDARS is a broadcast service from which consumers demand extremely high-quality service. With a digital broadcast system, the loss of an adequate signal can produce a total loss of audio. While people using mobile phones have accepted the fact that intermittent outages or bursts of noise occur during the course of a conversation, intermittent outages or bursts of noise will not be tolerated by an SDARS subscriber who is paying for uninterrupted, high-quality digital radio.

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Commerce (November 5, 1986).

³⁶ XM provides service to its subscribers directly through its licensed SDARS satellites in over 99% of its coverage area.

As described in Exhibit A, in order to provide SDARS receivers with reasonable protection from harmful interference, the Commission must establish new, more stringent out-of-band emissions limits in the 2320-2345 MHz band. Specifically, XM urges the Commission to establish an out-of-band emissions limit into the 2320-2345 MHz band of no more than 18 $\mu\text{V/m}$ at 3 meters measured in a 2 MHz interval for unlicensed devices operating exclusively inside of vehicles and 8.6 $\mu\text{V/m}$ at 3 meters measured in a 1 MHz interval for all unlicensed devices in all other environments. These limits will apply to all unlicensed devices operating pursuant to Part 15, Part 18 devices operating in the 2.4 GHz band, and to family radios operating on Channels 8-14.

The current Part 15 limit of 500 $\mu\text{V/m}$ equates to an out-of-band emissions level of -41 dBm/1MHz at the source. As discussed in Exhibit A, at -41 dBm, the separation distance required to ensure that the out-of-band emissions would not interfere with the SDARS receiver would be approximately 30 meters. Clearly, there is no way to achieve this type of separation distance if an unlicensed device is operating in an automobile or in the same room as an SDARS receiver. In the case of RF lighting devices, even though the distance between the SDARS antenna and the light could be 20 feet, its enormous transmit power, if not limited to the same 8.6 $\mu\text{V/m}$ at 3m level, would overpower the SDARS satellite signal.

XM's proposed out-of-band emissions limits are less stringent for unlicensed devices that operate exclusively in a vehicle. This is because an XM receiver in a vehicle operates with a roof mounted antenna that is shielded from an unlicensed device operating inside of the vehicle by the metal of the roof as well as the silvering on the glass.³⁷ In a home environment, however,

³⁷ XM has begun discussions with the Automotive Multimedia Interface Collaboration (AMIC), which develops technical specifications for electronic systems installed in
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an unlicensed device, such as a 2.4 GHz cordless phone, could operate directly next to a SDARS antenna placed on a window sill, causing harmful interference. In addition, devices that are capable of operating outdoors, such as RF lights or a mobile phone or a laptop equipped with a Bluetooth device, could operate in close proximity to a roof-mounted SDARS antenna without the benefit of shielding. Thus, to the extent an unlicensed device can operate both inside an automobile and outdoors or in a home, such as a mobile phone or laptop equipped with a Bluetooth device, then the Commission should apply the more stringent emissions limit of 8.6 $\mu\text{V/m}$ at 3 meters to that device.

Accordingly, XM asks the Commission to amend Part 15, Part 18, and Part 95 of its rules to specify an out-of-band emissions limit into the 2320-2345 MHz band of no more than 18 $\mu\text{V/m}$ at 3 meters measured in a 2 MHz interval for unlicensed devices operating exclusively inside vehicles and 8.6 $\mu\text{V/m}$ at 3 meters measured in a 1 MHz interval for all other unlicensed devices.

B. There Is Ample Precedent for an Out-of-Band Emissions Limit of 8.6 $\mu\text{V/m}$ at 3 Meters to Protect SDARS

The more stringent of the two out-of-band emissions limits XM proposes herein -- 8.6 $\mu\text{V/m}$ at 3 meters measured in a 1 MHz interval for all devices not used exclusively in vehicles -- is actually less stringent than the out-of-band standard the Commission has imposed on WCS mobile devices to protect SDARS receivers.³⁸ In adopting this standard, the Commission noted

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vehicles. XM expects AMIC to issue a specification which requires all RF devices operating exclusively in cars to meet XM's proposed 18 $\mu\text{V/m}$ at 3 meter standard for the DARS band.

³⁸ See 47 C.F.R. § 27.53(a)(2). For WCS licensees operating in the 2305-2320 MHz and 2345-2360 MHz bands, the power of any emission in the DARS band must be attenuated below the transmitter power (P) by a factor of $110 + 10 \log(p)$ dB. Assuming a 1 watt

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that “[w]hile it is our desire to provide WCS licensees with the maximum flexibility to provide a wide range of services, we also must ensure that WCS operations do not cause harmful interference or disruption to adjacent satellite DARS reception.” *WCS Order* at ¶ 136.

In addition, XM’s proposed interference limit is higher than the limit negotiated by the FCC for terrestrial interference into SDARS receivers from Canadian and Mexican terrestrial systems near the border.³⁹ Thus, there is ample precedent for 8.6 $\mu\text{V}/\text{m}$ at 3 meters as the appropriate out-of-band emissions limit needed to adequately protect sensitive SDARS receivers from harmful interference from adjacent channel operations.

C. The Commission Must Act Now to Update Its Emissions Limits Before Unlicensed Devices Begin to Saturate the Market

The Commission must act quickly to adopt the emissions limits proposed herein. Attached is a study prepared by Comsearch which concludes that out-of-band interference from unlicensed devices into the SDARS band is minimal at the present time. *See Exhibit B.* Thus, at present, SDARS consumers can expect high-quality service. With the expected proliferation of unlicensed devices in the 2.4 GHz band and family radios in the coming years, however, this expectation is in jeopardy. Thus, now is the time for the Commission to act to ensure that these devices do not interfere with SDARS.

In addition, unlike XM, the manufacturers of unlicensed devices can take the steps necessary to prevent interference to SDARS reception. While SDARS radios are already in production and in the marketplace, XM understands that many of the different kinds of devices

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WCS mobile transmitter, this equates to a signal level of -80 dBm. XM’s proposed standard of 8.6 $\mu\text{V}/\text{m}$ at 3 meters equates to a signal level of -79.4 dBm.

expected to produce interference, such as Bluetooth devices, have yet to enter the manufacturing process. There is still time to make the necessary modifications to this equipment. Unlike SDARS radios, the necessary modifications can be made to these devices without jeopardizing the quality of their performance or their commercial viability. Thus, by acting now or in the near future, the Commission can prevent a serious problem from developing, and can do so at minimal cost.

D. Compliance With the Proposed Emissions Limits Is Technologically Feasible and Can Be Done at Minimal Cost

It is technologically feasible for unlicensed device manufacturers to comply with the emissions limits proposed herein, and they can do so at minimal cost. To do so, manufacturers will simply need to modify the existing design in order to meet the transmit mask as defined by the new emissions requirements and, if necessary, employ a notch filter at the SDARS frequencies. These technological fixes are expected to be of minimal cost. In fact, some Bluetooth device manufacturers are already meeting the emissions limits proposed herein. In addition, XM has led discussions with the Automotive Multimedia Interface Collaboration ("AMIC"), which has indicated that Bluetooth and other unlicensed RF devices to be employed in automobiles will be required to meet an out-of-band emissions limit of 18 $\mu\text{V/m}$ at 3 meters measured in a 2 MHz interval into the SDARS band.

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³⁹ *U.S.-Mexico DARS Agreement; Agreement Concerning the Coordination between U.S. Satellite Digital Audio Radio Service and Canadian Fixed Service and Mobile Aeronautical Telemetry Service in the band 2320-2345 MHz.*

E. Unlicensed Device Manufacturers Should Be Afforded Eighteen Months After Final Rules Are Adopted to Comply with the Emissions Limits Proposed Herein

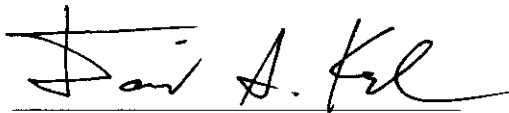
XM understands that it would be impossible for the Commission to retroactively apply these emissions limits to existing devices. XM also understands that unlicensed device manufacturers need sufficient notice of these new emissions limits to accommodate the design changes required to meet the new transmit mask or, if necessary, to add the filters needed to meet these limits. For this reason, XM believes the Commission should apply the proposed field strength limitations only to products sold 18 months after a final rule is published. XM understands that grandfathered unlicensed devices may present an interference concern, but believes that such a sacrifice is necessary to afford unlicensed device manufacturers a smooth transition to the new standards.

Conclusion

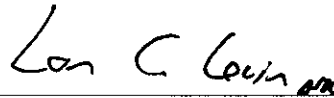
For all of the aforementioned reasons, the Commission should adopt XM's proposals and update its Part 15, Part 18, and Part 95 rules to establish, effective 18 months after adoption, an out-of-band emissions limit into the 2320-2345 MHz band of no more than 18 $\mu\text{V/m}$ at 3 meters measured in a 2 MHz interval for all unlicensed devices operating exclusively inside of vehicles and 8.6 $\mu\text{V/m}$ at 3 meters measured in a 1 MHz interval for unlicensed devices operating in all other environments.

Respectfully submitted,

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